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### A bad example

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# International Comparisons of Cost and Productivity in Construction: A Bad Example

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## Abstract

In a report published in June 2012 the Business Council of Australia (BCA) reported that it costs considerably more to build a variety of types of infrastructure in Australia than it does in the US. Airports (90 per cent more costly) and hospitals (62 per cent) were quoted as the worst cases with other projects ranging from 26 to 43 per cent more. They used these figures to conclude that Australia is a high cost, low productivity environment for building infrastructure projects. These claims were based on cost/m<sup>2</sup> figures published by a major international construction consultancy. The method used by the BCA is flawed in two ways: one is the use of costs that are recognised as giving only the broadest of indications of probable costs and the second is the use of exchange rates to convert Australian construction costs to US dollars. Careful analysis of the methodology used, supported by a series of other comparisons based on other data sources and other conversion factors (purchasing power parities or PPPs), suggests that in real terms it probably costs no more to build in Australia than it does in the US and that it may well be cheaper to build in Australia than it is in the US.

**Keywords:** International comparisons, Construction costs, Purchasing power parities, Productivity

## Introduction

The following appeared in a leading national newspaper in June 2012 (Hepworth 2012)

Landmark research to be released today finds that, compared with the US, airports are 90 per cent more expensive to deliver, hospitals 62 per cent, shopping centres 43 per cent and schools 26 per cent.

The 'landmark research' was a report published by the Business Council of Australia (BCA 2012) that suggests that Australia is now a high cost, low productivity environment for construction work. The report was released just prior to an economic forum hosted by the Prime Minister. While much of the focus of the report was on large scale infrastructure projects it was not surprising that the figures that grabbed attention were the comparative costs for the construction of several types of building which were classified as infrastructure: schools, hospitals and large shopping centres.

The purpose of this paper is to examine the methods used to establish these comparative costs and to compare the result published by the BCA with the results of similar exercises based on different building costs and different cost conversion methods. Large scale projects such as the resources projects that are so much in the news are not examined here.

## The BCA Method

The basic building cost data for schools, hospitals and shopping centres were taken from Turner&Townsend's *International construction cost survey 2012* (Turner&Townsend, 2012). According to the BCA report (BCA 2102, p. 81) these estimated costs (expressed as \$/m<sup>2</sup> of floor area) were for 'producing each project according to local standards in each country.' The Australian costs for the various types of building project for 2011 were converted to USD

using an average exchange rate for that year to allow direct comparisons of costs in the two countries.

There are two potential flaws in this approach. The first relates to comparing what are treated as identical buildings ('standard projects') in the two countries when in fact the buildings may vary considerably not only between the two countries but within each country. These differences can be due to a range of factors including differences in building standards and client expectations. The second relates to the use of money market exchange rates to convert construction costs to a common currency. Before examining the results of similar comparisons using both different cost data and different cost conversion methods the flaws in the BCA method need to be explored in some detail.

With regard to the cost data used in the BCA report Turner & Townsend (2012, p. 1) note that:

Costs are dependent on building design, inclusions, exclusions and site conditions.  
Cost comparisons between countries are subject to different interpretations, building methods, and standards for costing, measurement and construction.

In effect what they compare is functionally similar buildings rather than identical projects and thus the costs provided give an indication of the cost a building of a particular type or function in each location. This is fundamentally different to comparing the cost to build the same building in different locations and while it is a valid comparison in some circumstances it is not valid when attempting the sort of comparison undertaken by the BCA. Taken at face value, as was done in two major newspapers (Hepworth 2012; Forrestal and Dodson 2012), it appears that building the same building of a given type in the USA and Australia is considerably more expensive in Australia.

The second concern is the way in which costs in AUD have been converted to USD. Obviously costs have to be expressed in the same currency before they can be compared but it is generally accepted that money market exchange rates do not provide a valid method for such conversions (see, for example, Vermande and van Mulligen 1999; NSI 2004; Walsh and Sawhney 2002; Best and Langston 2006, Best 2008). In the BCA exercise costs expressed in AUD are converted to USD using an annual average exchange rate. While the use of an annual average is probably better than using a single daily rate there have been considerable variations in the AUD/USD exchange rate over the years since the AUD was floated with monthly average rates as low as AUD1=0.50USD in 2001 and as high as AUD1=1.08USD in 2012 (x-rates.com 2012). As is demonstrated later apparent cost differences change markedly depending on the year and thus on the exchange rate used.

### **Using Purchasing Power Parities to Convert to a Common Currency**

Purchasing power parities (PPPs) are used by various agencies (notably the World Bank: see ICP 2011) to convert amounts of money initially expressed in various national currencies to a single common currency, typically USD. PPPs are, in effect, conversion rates that bring amounts in different currencies to a common base as well as adjusting for differing price levels between countries and thus for differences in purchasing power. Construction is a significant component of the overall (GDP level) PPPs produced by the World Bank as part of the International Comparison Program and industry-specific PPPs for construction (CPPPs) are also published (see, for example, OECD 2012). If CPPPs are used to convert construction costs to a common base then cost is really being measured in 'construction dollars' where one such dollar buys a similar amount of construction in each location. When national costs are expressed in such international construction dollars a different picture of relative costs emerges. In the following examples construction data for Australia and the USA obtained from several sources are used and the Australian costs converted to USD using both average exchange rates and PPPs.

### Some Examples Using Turner & Townsend Cost Data

Table 1 shows the data used and the results quoted in the BCA report.

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Airport terminal</b>	3550	6565	6757	+90%
<b>Shopping centre</b>	1560	2172	2235	+43%
<b>Hospital</b>	3300	5185	5337	+62%
<b>School</b>	1570	1919	1975	+26%

**Table 1 2011: Turner & Townsend data, annual average exchange rate (0.97AUD=1USD)**

When the same basic data is used but the Australian costs are converted to USD using PPP the results are quite different as shown in Table 2. The PPP used is a GDP PPP rather than a CPPP. This has been done as CPPPs are not usually published with the same frequency as GDP level PPPs. In 2005 and 2008, the last years that CPPPs are available for, there was negligible difference between the general PPPs and CPPPs for the two countries. (OECD 2012: see tables for 2005 and 2008 *PPP Benchmark results*).

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Airport terminal</b>	3550	6565	4208	+19%
<b>Shopping centre</b>	1560	2172	1392	-11%
<b>Hospital</b>	3300	5185	3323	negligible
<b>School</b>	1570	1919	1230	-22%

**Table 2 2011: Turner & Townsend data, GDP PPP (1.56AUD=1USD) (OECD 2012)**

Use of a more appropriate conversion rate produced very different results with only the airport terminal appearing to be more costly in Australia. Given the great variability in airport terminal size and design it is arguable that the airport example is not appropriate in any case; even it were the difference now is quite small and a far cry from the 90% quoted by the BCA. It is also worth noting the BCA report talks of 'airports' while the Turner & Townsend data is for 'airport terminals'.

To further illustrate the inappropriateness of exchange rates for these cost conversions cost data for 2008 from Turner & Townsend was used again with both annual exchange rate conversions and PPP conversions. Tables 3 and 4 show the results. In view of the potential variability of airport terminal size and design they have been omitted in these comparisons.

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Shopping centre</b>	1580	2200	1876	+19%
<b>Hospital</b>	3000	5500	4691	+56%
<b>School</b>	1450	1985	1693	+17%

**Table 3 2008: Turner & Townsend data, annual average exchange rate (1.17AUD=1USD)**

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Shopping centre</b>	1580	2200	1477	-7%
<b>Hospital</b>	3000	5500	3691	+23%
<b>School</b>	1450	1985	1332	-8%

**Table 4 2008: Turner & Townsend data, GDP PPP (1.49AUD=1USD) (OECD 2012)**

The difference in the exchange rate (Table 3) sees substantial changes in the apparent cost differences for shopping centres and schools while the PPP based results (Table 4) again

show shopping centres and schools being less costly in Australia than in the US. In most cases, however, there are still substantial differences between results in spite of the short time between observations (only three years). This illustrates the coarse nature of this sort of comparison where the basic cost data provides nothing more than an indication of the relative costs between locations. What is clear, however, is that the example quoted by the BCA is the one that shows the Australian industry in the least favourable light.

### Examples Using Cost Data from Other Sources

Other construction cost consultants apart from Turner & Townsend regularly publish similar international construction cost comparisons. These include Davis Langdon, Rider Levett Bucknall, Rawlinsons, EC Harris and Gardiner & Theobald. Typically these costs are published as a promotional exercise rather than as serious rigorous comparisons and they usually carry disclaimers, e.g. Rawlinsons (2012, p. 868) say: “Costs given are average prices for typical buildings, they provide no more than a rough guide to the probable cost” [emphasis added].

Rawlinsons publish international cost/m<sup>2</sup> rates for a small number of building types not including schools or hospitals. Shopping centres are represented only as ‘Retail (shell construction for letting)’. While the BCA report is about infrastructure costs it does include building types that might be described as social infrastructure (schools, hospitals) but which are constructed using normal building methods rather than heavy engineering construction methods. Unlike much of the large infrastructure projects in Australia these buildings are not generally affected by the cost and logistical problems associated with construction in remote locations. It is therefore reasonable to make some comparisons based on Rawlinsons data for several building types which may actually be more comparable than buildings such as airport terminals and hospitals and which are certainly more easily compared than ports and oil platforms. The following tables show results based on Rawlinsons data for typical retail, hotel and industrial (factory/warehouse) buildings. Once again the Australian costs are converted to USD using both annual average exchange rates and PPPs.

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Retail (shell construction for letting)</b>	888	1115	1152	+30%
<b>Hotel (medium rise, three star)</b>	1995	3648	3768	+89%
<b>Factory/warehouse (owner occupied)</b>	720	530	548	-24%

Table 5 2011: Rawlinsons data, annual average exchange rate (0.97AUD=1USD)

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Retail (shell construction for letting)</b>	888	1115	715	-19%
<b>Hotel (medium rise, three star)</b>	1995	3648	2338	+17%
<b>Factory/warehouse (owner occupied)</b>	720	530	340	-53%

Table 6 2011: Rawlinsons data, GDP PPP (1.56AUD=1USD) (OECD 2012)

Again use of PPPs suggests that the BCA conclusions are not well founded with two building types apparently costing less in real terms in Australia than in the US. The apparent difference in hotel costs is much reduced by the PPP conversion and given the approximate nature of the base data there may actually be little difference in practice.

Davis Langdon publishes an annual report called The Blue Book (Davis Langdon 2012). The following tables (Tables 7 and 8) use their 2011 data (published in 2012) and again the same two conversion methods are used.

The differences are quite unlike anything seen in the earlier exercises. Expressed differently Table 7 suggests it costs close to double to build a school or factory in the US and more than 80% more to build a hospital. Table 8 suggests around three times as much to build a school, factory or hospital and twice as much to build a shopping centre; even the hotel now appears slightly more expensive in the US. Based on these results one would conclude that the Australian construction industry builds more cheaply than the US industry and thus may be more productive. It is important to note that higher or lower construction costs do not automatically imply higher or lower productivity although the BCA report and certainly those writing newspaper articles based on the BCA report seem to make a very clear connection between costs and productivity.

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Shopping centre</b>	3033	2353	2424	-20%
<b>Hotel (three star)</b>	2183	3036	3127	+43%
<b>School</b>	3267	1600	1648	-50%
<b>Hospital</b>	7033	3771	3864	-45%
<b>Light duty factory</b>	1267	637	657	-48%

**Table 7 2011: Davis Langdon data, annual average exchange rate (0.97AUD=1USD)**

	US cost/m <sup>2</sup> (USD)	Aus cost/m <sup>2</sup> (AUD)	Aus cost/m <sup>2</sup> (USD)	Difference
<b>Shopping centre</b>	3033	2353	1508	-50%
<b>Hotel (three star)</b>	2183	3036	1946	-11%
<b>School</b>	3267	1600	1026	-69%
<b>Hospital</b>	7033	3771	2417	-66%
<b>Light duty factory</b>	1267	637	408	-68%

**Table 8 2011: Davis Langdon data, GDP PPP (1.56AUD=1USD) (OECD 2012)**

## Discussion

The foregoing analysis leads to a number of observations. The first is that the method used to convert costs to a common currency is a key factor in determining the outcomes of these comparisons.

It is worth noting at this point that how costs are converted and what is the most appropriate way to do it depends on the purpose of the conversion. Travellers are naturally interested in exchange rates as the rate determines how much of their national currency they will need to spend in order to make purchases in another. A firm planning to fund construction in another country using money in their home currency will make conversions similar to those made by an intending traveller as again the question will be how much of their home currency they need to convert in order to purchase construction elsewhere.

If the same firm were planning to build overseas and to fund that construction from borrowings and/or income generated in that same location then they will be interested in local construction costs and probably no conversion is necessary.

What the BCA has done is to make the sort of conversion that travellers make and then to draw conclusions about price levels and productivity comparisons. This is not a valid approach as what is needed is a method that allows volumes of construction to be compared and this is where purchasing power parities (PPPs) comes into play. The 'volume' of



construction can really only be measured in terms of the value of what is built and value can really only be expressed in money. These amounts cannot be compared unless they are in the same currency or some other form of common metric. PPPs allow volumes of output to be compared without the distortions caused either by money market (exchange rate) fluctuations or differences in price levels. What PPPs do is what their name suggests: they allow us to compare volumes of output in terms of what can be purchased with amounts of money in different currencies. The Big Mac Index (*The Economist* 2012) uses the cost of a standard hamburger in many countries to compare purchasing power and thus to identify under- and over-valued currencies. The basic theory is that if you can buy a Big Mac hamburger in Australia for AUD4.80 and in the US for USD4.20 then this implies an exchange rate of 1AUD=0.875USD as around 88 US cents buys as much hamburger (i.e. the same volume of output/hamburger) as one Australian dollar. If the two hamburgers are identical then it is assumed that have the same value (however it is measured, e.g. kilojoules, satisfaction, happiness).

Thus, when construction costs are compared using PPPs as the conversion factor, the value and volume of construction is being compared. This is a more robust method for comparing cost and (perhaps) productivity than the traveller's method.

The second point is that the cost data must be treated with caution. This is well illustrated by, for example, the very large variance in published \$/m<sup>2</sup> costs for hospital construction: for 2011 Turner & Townsend suggest US costs of USD3300/m<sup>2</sup> while Davis Langdon suggests USD7033/m<sup>2</sup> – more than double the Turner & Townsend figure. In contrast the corresponding costs for Australian hospitals are AUD5185/m<sup>2</sup> (Turner & Townsend) and AUD3771/m<sup>2</sup> (Davis Langdon) – the Davis Langdon figure is now less than 75% of the Turner & Townsend figure. While it may be that the two sets of costs cover different scopes of work it must be assumed that each source is presenting costs for very similar projects, i.e. the costs for hospitals in Turner & Townsend's data are for comparable projects and the same must apply to Davis Langdon even though it may not be appropriate to compare a Turner & Townsend cost directly with one from Davis Langdon or some other source. The question must be asked: why do US costs vary so much in one direction and Australian costs vary considerably in the opposite direction? Are the hospitals being compared within each of the studies actually comparable? It is easy to assume the first difference (USD3300 compared to USD7033 for US hospitals) is explained by differences in the scope or nature of the projects being compared given that the costs come from different sources – but how then can the opposite relativity (AUD5185 and AUD3771) for Australian hospitals be explained? If the higher figure in the first case can be attributed to, say, the inclusion of fittings and equipment in one but not the other then surely the same would apply for the Australian costs and they would be higher in the Davis Langdon data rather than lower. What this illustrates quite clearly is that these costs are nothing more than rough guides, as Rawlinsons clearly say, and they should not be relied on for serious comparative studies.

### Concluding Remarks

The foregoing analysis demonstrates how easy it is to take some figures at face value and make broad statements about what they show. This makes good newspaper fodder but as Shakespeare said "comparisons are odorous" and this is surely the case with the BCA report as the generalisations made about relative cost and productivity in regard to the Australian construction industry are easily shown to be very dubious when the methodology is examined. It is counter-intuitive in the extreme to imagine that in an area of highly mechanised, computer-assisted construction technology and management practices that productivity in the industry is falling or, at best, stagnant. Buildings are certainly more complex than they were even 20 or 30 years ago and while factors such as improved safety standards may slow work down this is surely more than offset by other advances such as the

use of offsite fabrication and the ubiquitous concrete pumps that have all but replaced the much slower crane-based concrete placement methods of the past.

What the BCA report represents is fundamentally bad 'research' where someone found some figures that made a good story but then either lacked the knowledge or did not bother to examine those figures to see what they were intended for and what they were actually based on.

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